**IIT JEE 2009 Chemistry Paper1 Solutions**

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| **SINGLE CORRECT CHOICE TYPE****1.**  The Henry's law constant for the solubility of N2 gas in water at 298 K is 1.0 × 105 atm. The mole fraction of N2 in air is 0.8. The number of moles of N2 from air dissolved in 10 moles of water at 298 K and 5 atm pressure is        (A)    4.0 × 10-4        (B)    4.0 × 10-5        (C)    5.0 × 10-4        (D)    4.0 × 10-6 **Sol.   (A)**        According to Henry's law        P = KH *ΧN2*         0.8 × 5 = 1 × 105 × *ΧN2*        *ΧN2* = 4 × 10-5 (in moles of water)        Þ 4 × 10-5 = η N2 / (η N2 + 10)        η *H2* × 5 × 10-5 + 4 × 10-4 = η *H2*        => η *H2* = 4 × 10-4 **2.**   The correct acidity order of the following is         acidity-order         (A)    (III) > (IV) > (II) > (I)        (B)    (IV) > (III) > (I) > (II)        (C)    (III) > (II) > (I) > (IV)        (D)    (II) > (III) > (IV) > (I) **Sol.   (A)**         order of acidity         The electron withdrawing group increases acidity and electron donating group decreases acidity.        Decreasing order of acidic strength: III > IV > II > I |

**3.**   The reaction of P4 with X leads selectively to P4O6. The X is

        (A)    Dry O2

        (B)    A mixture of O2 and N2

        (C)    Moist O2

        (D)    O2 in the presence of aqueous NaOH

**Sol.   (B)**

                               N2
        P4 + 3O2   -------------->    P4O6 (exclusively)

        (N2 is used to retard the further oxidation)

**4.**    Among cellulose, poly(vinyl chloride), nylon and natural rubber, the polymer in which the intermolecular force of attraction is weakest is

        (A)    Nylon

        (B)    Poly (vinyl chloride)

        (C)    Cellulose

        (D)    Natural Rubber

**Sol.   (D)**

        The chain of natural rubber involves weak Vander Waal's force of interaction.

**5.**     Given that the abundances of isotopes 54Fe, 56Fe and 57Fe are 5%, 90% and 5% respectively, the atomic mass of Fe is

        (A)    55.85

        (B)    55.95

        (C)    55.75

        (D)    56.05

**Sol.   (B)**

        A- = ∑ AiXi/∑ Xi

        A- = 54 × 0.05 + 56 × 0.90 + 57 × 0.05 (where A- is atomic mass of Fe)

        A- = 55.95

**6.**     The IUPAC name of the following compound is

        

        (A)    4-Bromo-3-cyanophenol

        (B)    2-Bromo-5-hydroxybenzonitrile

        (C)    2-Cyano-4-hydroxybromobenzene

        (D)    6-Bromo-3-hydroxybenzonitrile

**Sol.   (B)**

        The CN group has a higher priority over the OH and Br group.

**7.**   Among the electrolytes Na2SO4, CaCl2, Al2(SO4)3 and NH4Cl, the most effective coagulating agent for Sb2S3 sol is

        (A)    Na2SO4

        (B)    CaCl2

        (C)    Al2(SO4)3

        (D)    NH4Cl

**Sol.   (C)**

        As Sb2S3 is a negative sol, so, Al2(SO4)3 will be the most effective coagulant due to higher charge density on Al3+ in accordance with hardy-Schulze rule.

        Order of effectiveness of cations: Al3+ > Ca++ > Na+ > NH

**8.**     The term that corrects for the attractive forces present in a real gas in the Vander Waals equation is

        (A)    nb

        (B)    an2/V2

        (C)    - an2/V2

        (D)    -nb

**Sol.   (B)**

        In the given Vander Waals equation:

        (P + n2 a/V2 )(V - nb) = nRT

        The measure of force of attraction for 'n' moles of real gas is given by n2 a/V2

**MULTIPLE CORRECT CHOICE TYPE**

**9.** The compound(s) formed upon combustion of sodium metal in excess air is (are)

        (A)    Na2O2

        (B)    Na2O

        (C)    NaO2

        (D)    NaOH

**Sol.   (A, B)** in dry air. Sodium metal do not for super oxide.

**10.**   The correct statement(s) about the compound

H3C(HO)HC-CH=CH-(OH)CH3 (X) is(are)

(A)    The total number of stereoisomer

(B)    The total number of diastereomers possible for X is 3

(C)    If the stereochemistry about the double bond in x is trans, the number of enantiomers possible for X is 4

(D)    If the stereochemistry about the double bond is X is cis, the number of enantiomers possible for X is 2

**Sol.   (A, D)**

**11.**    The compound(s) that exhibit(s) geometrical isomerism is (are)

        (A)    [Pt(en)CI2]

        (B)    [Pt(en)2]CI2

        (C)    [Pt(en)2CI2]CI2

        (D)    [Pt(NH3)2CI2]

**Sol.   (C, D)**

          

**12.**    The correct statement(s) regarding defects in solids is(are)

(A)    Frenkel defect is usually favoured by a very small difference in the sizes of cation and anion

(B)    Frenkel defect is a dislocation defect

(C)    Trapping of an electron in the lattice leads to the formation of F-center

(D)    Schottky defects have no effect on the physical properties of solids

**Sol.   (B, C)**

        Frenkel defect is favoured when the difference in the size of one cation and anion is quite large. Schottky defect decreases density of the solid.

**COMPREHENSION TYPE**

A carbonyl compound P, which gives positive idoform test, undergoes reaction with MeMgBr followed by dehydration to give an olefin Q. Ozonolysis of Q leads to a dicarbonyl compound R, which undergoes intramolecular aldol reaction to give predominantly S.



**13.**    The structure of the carbonyl compound P is

        

**Sol.   (B)**

**14.**    The structure of the products Q and R, respectively are

    

**Sol.   (A)**

**15.** structure of the product S is

        

**Sol.   (B)**

Solution for the question nos. 13 to 15



**Paragraph**

p-Amino-N, N-dimethylaniline is added to a strongly acidic solution of X. The resulting solution is treated with a few drops of aqueous solution of Y to yield blue colouration due to the formation of methylene blue. Treatment of the aqueous solution of Y with the reagent potassium hexcyanoferrate (II) leads to the formation of an intense blue precipitate. The precipitate dissolves on excess addition of the reagent. Similarly, treatment of the solution of Y with the solution of potassium hexacyanoferrate (III) leads to a brown colouration due to the formation of Z.

**16.**   The compound X is

        (A)    NaNO3

        (B)    NaCl

        (C)    Na2SO4

        (D)    Na2S

**Sol.   (D)**

**17.**    The compound Y is

        (A)    MgCI2

        (B)    FeCI2

        (C)    FeCI3

        (D)    ZnCI2

**Sol.   (C)**

**18.**    The compound Z is

        (A)    Mg2[Fe(CN)6]

        (B)    Fe[Fe(CN)6]

        (C)    Fe4[Fe(CN)6]3

        (D)    K2Zn3[Fe(CN)6]2

**Sol.   (B)**

Solution for the question nos. 16 to 18

     

        (X) - Na2S

        (Y) - FeCI3

        (Z) - Fe[Fe(CN)6]

**Matrix Match Type**

**19.**   Match each of the compounds in Column I with its characteristic reaction(s) in Column II.

|  |  |
| --- | --- |
| **Column I** | **Column II** |
| (A) | CH3CH2CH2CN | (p) | Reduction with Pd-C/H2 |
| (B) | CH3CH2OCOCH3 | (q) | Reduction with SnCI2/HCI |
| (C) | CH3-CH=CH-CH2OH | (r) | Development of foul smell on treatment with chloroform and alcoholic KOH |
| (D) | CH3CH2CH2CH2NH2 | (s) | Reduction with diisobutylaluminium hydride (DIBAL-H) |
|   |   | (t) | Alkaline hydrolysis |

**Sol.   (A - p, q, s, t) (B - s, t) (C - p) (D - r)**

**20.**  Match each of the diatomic molecules in Column I with its property/properties in Column II.

|  |  |
| --- | --- |
| **Column I** | **Column II** |
| (A) | B2 | (p) | Paramagnetic |
| (B) | N2 | (q) | Undergoes oxidation |
| (C) | O2- | (r) | Undergoes reduction |
| (D) | O2 | (s) | Bond order > 2 |
|   |   | (t) | Mixing of 's' and 't' orbitals |

**Sol    (A - p, r, t), (B - s, t), (C - p, q), (D - p, q, s)**